

WHAT IS CLAIMED IS:

1. A fabric softening composition comprising:

- (A) an effective amount to soften fabric, of polyalkyleneoxy polysiloxane selected from the group consisting of polyethyleneoxy polysiloxane, polyethyleneoxy/polypropyleneoxy polysiloxanes, and mixtures thereof, having an average molecular weight of from about 3,000 to about 200,000, and being characterized by Correlation I:

$$S = 3.246(\sqrt{t\#diSi}) - 1.880(\sqrt{\%Si}) - 0.9066\sqrt{t\#EO} + 17.70 \quad (I)$$

wherein $t\#diSi$ is the average total number of the $Si(CH_3)_2O$ units in the molecule; $t\#EO$ is the average total number of the ethyleneoxy CH_2CH_2O units in the molecule; $\%Si$ is the weight percent of all siloxane units in the molecule; and the softness index S is at least about 10;

- (B) optionally, an effective amount of fabric wrinkle control agent;
- (C) optionally, an effective amount to provide olfactory effects of perfume;
- (D) optionally, an effective amount to improve the performance of the composition, of surfactant;
- (E) optionally, an effective amount, to kill, or reduce the growth of microbes, of antimicrobial active;
- (F) optionally, an effective amount to assist in antimicrobial action of aminocarboxylate chelator;
- (G) optionally, an effective amount to control malodor, of odor controlling agent;
- (H) optionally, an effective amount of antimicrobial preservative;
- (I) optionally, an effective amount of adjunct quaternary ammonium fabric softening agent;
- (J) optionally, adjunct material selected from the group consisting of chemical stabilizer including antioxidant, static control agent, suds suppressor, soil release agent, colorant, brightener, insect repelling agent, moth repelling agent, and mixtures thereof; and
- (K) aqueous carrier,

wherein said composition contains at least one of (B) through (J).

2. The composition of Claim 1 wherein said S has a value of at least about 20.

3. The composition of Claim 2 wherein said S has a value of at least about 25.
4. The composition of Claim 3 wherein said S has a value of at least about 30.
5. The composition of Claim 1 wherein said t#diSi is from about 4 to about 600.
6. The composition of Claim 5 wherein said t#diSi is from from about 40 to about 530.
7. The composition of Claim 6 wherein said t#diSi is from about 75 to about 520.
8. The composition of Claim 7 wherein said t#diSi is from about 90 to about 510.
9. The composition of Claim 1 wherein said t#EO is from about 30 to about 2,200.
10. The composition of Claim 9 wherein said t#EO is from about 100 to about 1,800.
11. The composition of Claim 10 wherein said t#EO is from about 120 to about 1,500.
12. The composition of Claim 11 wherein said t#EO is from about 200 to about 1,200.
13. The composition of Claim 1 wherein said %Si is from about 3 to about 65.
14. The composition of Claim 13 wherein said %Si is from about 5 to about 62.
15. The composition of Claim 14 wherein said %Si is from about 9 to about 60.
16. The composition of Claim 15 wherein said %Si is from about 12 to about 60.
17. The composition of Claim 1 wherein said polyalkyleneoxy polysiloxane has a molecular weight of from about 7,500 to about 140,000.

18. The composition of Claim 17 wherein said polyalkyleneoxy polysiloxane has a molecular weight of from about 14,000 to about 110,000.
19. The composition of Claim 18 wherein said polyalkyleneoxy polysiloxane has a molecular weight of from about 20,000 to about 80,000.
20. The composition of Claim 19 wherein said polyalkyleneoxy polysiloxane has a molecular weight of from about 20,000 to about 40,000.
21. The composition of Claim 1 wherein said polyalkyleneoxy polysiloxane is polyethyleneoxy polysiloxane.
22. The composition of Claim 1 wherein said polyalkyleneoxy polysiloxane is polyethyleneoxy/ polypropyleneoxy polysiloxane.
23. The composition of Claim 1 wherein said polyalkyleneoxy polysiloxane is present at a level of from about 0.01% to about 10%, by weight of the composition.
24. The composition of Claim 23 wherein said polyalkyleneoxy polysiloxane is present at a level of from about 0.2% to about 3%, by weight of the composition.
25. The composition of Claims 24 wherein said polyalkyleneoxy polysiloxane is present at a level of from about 0.3% to about 2%, by weight of the composition.
26. The composition of Claim 1 wherein said fabric wrinkle control agent is selected from the group consisting of fabric lubricant, shape retention polymer, fabric care polysaccharide, hydrophilic plasticizer, and mixtures thereof, and present at a level of from about 0.05% to about 5%.
27. The composition of Claim 1 wherein said perfume is present at a level of from about 0.003% to about 0.5%, by weight of the composition, and wherein said perfume comprises at least about 25%, by weight of the perfume composition of substantive perfume ingredients that have a boiling point of at least about 250°C.

28. The composition of Claim 27 wherein said substantive perfume ingredients are selected from the group consisting of allyl cyclohexane propionate, ambrettolide, amyl benzoate, amyl cinnamate, amyl cinnamic aldehyde, amyl cinnamic aldehyde dimethyl acetal, iso-amyl salicylate, hydroxycitronellal-methyl anthranilate, benzophenone, benzyl salicylate, iso-butyl quinoline, beta-caryophyllene, cadinene, cedrol, cedryl acetate, cedryl formate, cinnamyl cinnamate, cyclohexyl salicylate, cyclamen aldehyde, dihydro isojasmonate, diphenyl methane, diphenyl oxide, dodecalactone, 1-(1,2,3,4,5,6,7,8-octahydro-2,3,8,8-tetramethyl-2-naphthalenyl)-ethanone, ethylene brassylate, ethyl methyl phenyl glycidate, ethyl undecylenate, iso-eugenol, 15-hydroxypentadecanoic acid lactone, 1,3,4,6,7,8-hexahydro-4,6,6,7,8,8-hexamethylcyclopenta-gamma-2-benzopyran, geranyl anthranilate, hexadecanolide, hexenyl salicylate, hexyl cinnamic aldehyde, hexyl salicylate, para-tertiary-butyl-alpha-methyl hydrocinnamic aldehyde, linalyl benzoate, 2-methoxy naphthalene, methyl cinnamate, methyl dihydrojasmonate, beta-methyl naphthyl ketone, musk indanone, musk ketone, musk tibetine, myristicin, delta-nonolactone, oxahexadecanolide-10, oxahexadecanolide-11, patchouli alcohol, 5-acetyl-1,1,2,3,3,6-hexamethylindan, phenyl ethyl benzoate, phenylethylphenylacetate, phenyl heptanol, phenyl hexanol, alpha-santalol, 15-hydroxypentadecanoic acid, lactone, tonalid, delta-undecalactone, gamma-undecalactone, vetiveryl acetate, yara-yara, allyl phenoxy acetate, cinnamic alcohol, cinnamic aldehyde, cinnamyl formate, coumarin, dimethyl benzyl carbinyl acetate, ethyl cinnamate, ethyl vanillin (3-methoxy-4-ethoxy benzaldehyde), eugenol, eugenyl acetate, heliotropine, indol, isoeugenol, koavone, methyl-beta-naphthyl ketone, methyl cinnamate, methyl dihydrojasmonate, beta methyl naphthyl ketone, methyl-n-methyl anthranilate, delta-nonolactone, gamma-nonolactone, para methoxy acetophenone (acetanisole), phenoxy ethyl iso butyrate, phenoxy ethyl propionate, piperonal, triethyl citrate, vanillin, and mixtures thereof.

29. The composition of Claim 1 wherein said surfactant is present at a level of from about 0.05% to about 5%, by weight of the composition, and selected from the group consisting of nonionic surfactant, anionic surfactant, cationic surfactant, amphoteric surfactant, and mixtures thereof.

30. The composition of Claim 29 wherein said surfactant is nonionic surfactant present at a polyethyleneoxy polysiloxane/nonionic surfactant weight ratio of from about 4:1 to about 1:3.

31. The composition of Claim 1 wherein said antimicrobial active is present at a level of from about 0.001% to about 0.8%, by weight of the composition.
32. The composition of Claim 1 wherein said odor controlling agent is selected from the group consisting of uncomplexed cyclodextrins; zinc and copper salts; soluble carbonate and/or bicarbonate salts; water soluble ionic polymers; and mixtures thereof; and is present at a level of from about 0.01% to about 5%, by weight of the composition.
33. The composition of Claim 1 wherein said adjunct quaternary ammonium fabric softening agent is present at a level of from about 0.05% to about 3%, by weight of the usage composition.
34. The composition of Claim 1 wherein said aqueous carrier is water, said composition optionally containing from 0% to about 20%, by weight of the total composition, of low molecular weight water soluble organic solvent, selected from the group consisting of ethanol, isopropanol, propanol, and mixtures thereof.
35. The composition of Claim 1 which is a concentrated composition to be diluted for use, wherein:
- (A) the level of said polyalkyleneoxy polysiloxane is from about 1% to about 30%, by weight of the composition;
 - (B) when present, the level of said optional fabric wrinkle control agent is of from about 1% to about 20%, by weight of the composition;
 - (C) when present, the level of said optional perfume is from about 0.01% to about 5%, by weight of the composition;
 - (D) when present, the level of said optional surfactant is from about 0.1% to about 15%, by weight of the composition;
 - (E) when present, the level of said optional antimicrobial active is from about 0.003% to about 2%, by weight of the composition; and
 - (G) when present, the level of said odor controlling agent is from about 1% to about 20%, by weight of the composition.

36. An article of manufacture comprising the fabric softening composition of Claim 1 in a package in association with instructions for use which direct the consumer to apply at least an effective amount of said fabric softening composition and/or polyalkyleneoxy polysiloxane on fabric to provide a fabric softening benefit.

37. The article of Claim 36 wherein said composition additionally provides at least one of the following fabric care benefits: wrinkle removal, wrinkle reduction, wrinkle resistance, fabric wear reduction, fabric wear resistance, fabric pilling reduction, fabric color maintenance, fabric color fading reduction, fabric color restoration, fabric soiling reduction, fabric soil release, fabric shape retention, and/or fabric shrinkage reduction in a package in association with instructions for use which direct the consumer to apply at least an effective amount of said composition to provide at least one of said fabric care benefits.

38. The article of Claim 37 wherein the fabric softening composition is in a spray dispenser.

39. The article of Claim 38 wherein said spray dispenser comprises a manually activated sprayer selected from the group consisting of trigger sprayer, pump sprayer, non-aerosol self-pressurized sprayer, and aerosol sprayer, or a non-manually operated, powered sprayer, selected from the group consisting of powered sprayer, air aspirated sprayer, liquid aspirated sprayer, electrostatic sprayer, and nebulizer sprayer.

40. The article of Claim 36 wherein said instructions for use direct the consumer to apply an amount of composition to provide from about 0.005% to about 5%, by weight of the fabric.

41. The article of Claims 40 wherein said instructions for use direct the consumer to apply an amount of composition to provide from about 0.01% to about 2%, by weight of the fabric.

42. The article of Claim 41 wherein said instructions for use direct the consumer to apply an amount of composition to provide from about 0.1% to about 1% of polyalkyleneoxy polysiloxane, by weight of the fabric.

43. The article of Claim 36 wherein said instructions for use include pictures and/or icons.

44. An article of manufacture comprising a concentrated composition of Claim 35 in association with instructions for use which direct the consumer to dilute said composition to form a diluted fabric softening composition.

45. An article of manufacture comprising the composition of Claim 1 to apply to fabric in the drying step, packaged in association with instructions for use which direct the consumer to apply at least an effective amount of said composition to said fabric to provide said fabric care benefits.

46. An article of manufacture comprising the composition of Claim 1 to be applied directly to a garment in a manner such that excessive amounts of the fabric softening composition are prevented from being released to the open environment, packaged in association with instructions for use which direct the consumer to apply at least an effective amount of said polyalkyleneoxy polysiloxane to said garment in said manner to provide said fabric softening benefit.

47. Fabric having improved characteristics having an effective amount polyalkyleneoxy polysiloxane of Claim 1 attached thereto.

48. A method for providing a fabric with a fabric softening benefit wherein said method comprises spraying said fabric with an effective amount of polyalkyleneoxy polysiloxane of Claims 1.

49. The method of Claim 48 wherein said method does not comprise ironing.

50. The method of Claim 48 wherein said method additionally provides at least one of the following fabric care benefits: wrinkle removal, wrinkle reduction, wrinkle resistance, fabric wear reduction, fabric wear resistance, fabric pilling reduction, fabric color maintenance, fabric color fading reduction, fabric color restoration, fabric soiling reduction.

51. The method of Claim 48 wherein said composition is sprayed onto said fabric as droplets by using a spray dispenser.

52. The method of Claim 48 wherein said composition is applied to fabric in the drying step.

53. The method of Claim 48 wherein said fabric is wet.

54. A method for providing fabric color restoration by treating said color fabric with an effective amount of the composition of Claim 1.

55. Use of polyalkyleneoxy polysiloxane of Claim 1 in an aqueous fabric softening composition for direct application to fabric.

56. A method using the Correlation I of Claim 1 to design novel good performing polyalkyleneoxy silicones for use as fabric softening active in an aqueous fabric softening composition for direct application to fabric, and/or for use in fabric softening methods and/or articles of manufacture comprising said fabric softening compositions, said method comprises the following steps:

- (a) Choose a desired S value, typically at least about 20;
- (b) Set a desired average molecular weight, MW, being typically from from about 7,500 to about 140,000;
- (c) Set a desired %EO (weight % of all ethyleneoxy EO units in the molecule), then derive t#EO (the average total number of ethyleneoxy units in the molecule) with t#EO being typically from about 100 to about 1,800;
- (d) Choose the type of polyalkyleneoxy polysiloxane selected from polyethyleneoxy polysiloxane or polyethyleneoxy/ polypropyleneoxy polysiloxane, then set the desired %Si value;
- (e) Use the desired values for S, t#EO and %Si to calculate t#diSi (the approximated total average number of dimethylsiloxane SiMe₂O units in the molecule), using Correlation I, wherein t#diSi is typically about from about 40 to about 530;
- (f) Calculate %diSi (weight % of total dimethylsiloxane units) and %triSi (weight % of the terminal trimethylsiloxane units); and

(g) Calculate $t\#linkSi$ (the average number of the polyalkyleneoxy pendant groups).

57. Novel material capable of providing fabric softening benefit, said material being polyalkyleneoxy polysiloxane selected from the group consisting of polyethyleneoxy polysiloxane, polyethyleneoxy/polypropyleneoxy polysiloxanes, and mixtures thereof, having an average molecular weight of from about 3,000 to about 200,000, and being characterized by Correlation I:

$$S = 3.246(\sqrt{t\#diSi}) - 1.880(\sqrt{\%Si}) - 0.9066\sqrt{t\#EO} + 17.70 \quad (I)$$

wherein $t\#diSi$ is the average total number of the $Si(CH_3)_2O$ units in the molecule; $t\#EO$ is the average total number of the ethyleneoxy CH_2CH_2O units in the molecule; $\%Si$ is the weight percent of all siloxane units in the molecule; and the softness index S is at least about 15, excluding the following compounds: Silwet L-77, Silwet L-711, Silwet L-720, Silwet L-721, Silwet L-7000, Silwet L-7001, Silwet L-7002, Silwet L-7087, Silwet L-7200, Silwet L-7210, Silwet L-7220, Silwet L-7230, Silwet L-7280, Silwet L-7600, Silwet L-7602, Silwet L-7604, Silwet L-7605, Silwet L-7607, Silwet L-7608, Silwet L-7610, Silwet L-7614, Silwet L-7622, Silwet L-7644, Silwet L-7650, Silwet L-7657, Silwet L-8500, Silwet L-8600, Silwet L-8610, Silwet L-8620, Silwet FZ-2104, Silwet FZ-2120, Silwet FZ-2161, Silwet FZ-2162, Silwet FZ-2163, Silwet FZ-2164, Silwet FZ-2165, Silwet FZ-2166, Silsoft[®] 477, Silsoft 487, Silsoft 497, DC 190, DC 193, DC 25237, DC-2 5573, DC 3225C, DC 5093, DC 5097, DC 5098, DC 5103, DC 5197, DC 5200, DC 5211, DC 5212, DC 5220, DC 5225C, DC 5237, DC 5247, DC 5329, DC5604, DC 8692, DC Q2-2511, DC Q2-5220, DC Q4-3667, FF 400, Sylgard[®] 309, SH3771C, SH3772C, SH3773C, SH3746, SH3748, SH3749, SH8400, SF8410, SH8700, SF 1188A, SF 1288, SF 1388, SF 1488, SF 1328, SF 1528, TSF 4440, TSF 4441, TSF 4445, TSF 4446, TSF 4452, TSF 4450, OL 17, OL 31, OL 44, AC 3233, AI 3669, AI 3465, AI 3466, AI 3467, AI 3468, VP 3738, VP 3739, TP 3792, TP 3793, TP 3794, TP 3799, TP 3800, TP 3801, TP 3804, TP 3805, TP 3806, Abil[®] B 8800, Abil B 8830, Abil B 8832, Abil B 8842, Abil B 8843, Abil B 8847, Abil B 8851, Abil B 8852, Abil B 8863, Abil B 8873, Abil EM 97, Abil EM-90, Abil EM-97, Abil WE-09, Abil B 88183, Abil B 88184, Abil 9950, Abil EM-90, Abil WE-90, Abil Care 85, KF351, KF352, KF353, KF354, KF 355, KF615, KF618, KF 625, KF 857, KF 862, KF-888, KF945, KF-8001, X-22-3667, X-22-3939A, X-22-4741, X-22-6008, X-22-8645, Fancorsil[®] LIM 1, Fancorsil LIM 2, Fancorsil LIM 3, Alkasil[®] NE 58-50, Alkasil NEP 73-70, Alkasil[®] NEPCA 250-185, Rhodorsil[®] Oils 70646, Silbione[®] Oils 70646, Amersil[®] DMC-287, Amersil DMC-357,

Masil[®] 1066 D, Masil 280 LP, Silicone Copolymer F-754, Silicone Fluid VP, Belsil[®] DMC 6031, Belsil DMC 6032, Belsil DMC 6033, Belsil DMC 6035, Troysol[®] S366, Troysol 380W, and Forbest[®] G-23.

58. Novel material capable of providing fabric softening benefit, said material being polyalkyleneoxy polysiloxane selected from the group consisting of polyethyleneoxy polysiloxane, polyethyleneoxy/polypropyleneoxy polysiloxanes, and mixtures thereof, having an average molecular weight of from about 3,000 to about 200,000, and being characterized by Correlation I:

$$S = 3.246(\sqrt{t\#diSi}) - 1.880(\sqrt{\%Si}) - 0.9066\sqrt{t\#EO} + 17.70 \quad (I)$$

wherein $t\#diSi$ is the average total number of the $Si(CH_3)_2O$ units in the molecule; $t\#EO$ is the average total number of the ethyleneoxy CH_2CH_2O units in the molecule; $\%Si$ is the weight percent of all siloxane units in the molecule; and the softness index S is at least about 30.